WHAT IS CLAIMED IS:

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- 1. A method for forming a diffusion barrier layer comprising the steps of:
- a) preparing a silicon substrate;
- b) contacting the silicon substrate with a composition comprising self-
- 4 assembled monolayer subunits and a solvent; and,
 - c) removing the solvent
- 6 thereby forming the diffusion barrier.
- 1 2. The method according to claim \(\frac{1}{3} \), wherein the self-assembled
- 2 monolayer subunit is of the following structure:

$$Y$$
 Y
 Si
 R^2

wherein Y is an O-alkyl group, and wherein R² is an alkyl group, heteroalkyl group, aryl group or heteroaryl group.

3. The method according to claim 1, wherein the self-assembled monolayer subunit is of the following structure:



- wherein Y is a halogen, and wherein R² is an alkyl group, heteroalkyl group, aryl group or heteroaryl group.
- 1 4. The method according to claim 1, wherein the silicon substrate 2 preparation comprises the formation of a silicon oxide surface.
- 5. The method according to claim 1, wherein the method further comprises the step of heating the silicon substrate and the composition during contact.
- 1 6. The method according to claim 2, wherein R² is an alkyl group of the following structure:

$$-(CH2)n R3 R4$$

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- wherein R³, R⁴ and R⁵ are independently selected from the group consisting of hydrogen, 4
- alkyl groups, heteroalkyl groups, halo groups, NH₂, NHR⁶, NR⁶R⁷, OH, OR⁶, SH, SR⁶, CHO, 5
- COOH and CN, and wherein R⁶ and R⁷ are alkyl groups, and wherein n is an integer ranging 6
- 7 from 1 to 5.
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 - 2 following structure:
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 - 3 and wherein R³ and R⁴ are hydrogen and n is 2. 4

- The method according to claim 2, wherein R² is an alkyl group of the 7.
- wherein R³ and R⁴ are independently selected from the group consisting of hydrogen, alkyl groups, heteroalkyl groups, halo groups, NHR⁶, NR⁶R⁷, OH, OR⁶, SH, SR⁶, CHO,
- COOH and CN, and wherein R⁶ and R⁷ are alkyl groups, and wherein n is an integer ranging from 1 to 5.
 - 8. The method according to claim 6, wherein Y is OCH₃.
 - The method according to claim 7, wherein Y is OCH₃. 9.
 - The method according to claim 8, wherein R³, R⁴ and R⁵ are hydrogen 10.
- 2 and n is 2.
- The method according to claim 9, wherein R² is an alkyl group of the 11.
- following structure:

- 1 12. A diffusion barrier layer in an integrated circuit, wherein the diffusion
- 2 barrier comprises a self-assembled monolayer.
- 13. The diffusion barrier according to claim 12, wherein the self-assembled monolayer comprises subunits, and wherein the subunits are of the following
 - 3 structure:

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- 5 wherein R² is an alkyl group, heteroalkyl group, aryl group or heteroaryl group.
 - 14. The diffusion barrier according to claim 13, wherein \mathbb{R}^2 is an alkyl group of the following structure:

$$-(CH2)n R3 R4$$

- wherein R³, R⁴ and R⁵ are independently selected from the group consisting of hydrogen, alkyl groups, heteroalkyl groups, halo groups, NH₂, NHR⁶, NR⁶R⁷, OH, OR⁶, SH, SR⁶, CHO, COOH and CN, and wherein R⁶ and R⁷ are alkyl groups, and wherein n is an integer ranging from 1 to 5.
- 1 15. The diffusion barrier according to claim 13, wherein R² is an alkyl group of the following structure:

$$-(CH_2)_n$$
 R^3

- 4 wherein R³ and R⁴ are independently selected from the group consisting of hydrogen, alkyl
- 5 groups, heteroalkyl groups, halo groups, NH₂, NHR⁶, NR⁶R⁷, OH, OR⁶, SH, SR⁶, CHO,
- 6 COOH and CN, and wherein R⁶ and R⁷ are alkyl groups, and wherein n is an integer ranging
- 7 from 1 to 5.

- 1 16. The diffusion barrier according to claim 14, wherein R³, R⁴ and R⁵ are
- 2 hydrogen and n is 2.

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- 1 The diffusion barrier according to claim 15, wherein R² is an alkyl
- 2 group of the following structure:

$$-(CH)_n \xrightarrow{N} \mathbb{R}^3$$

- 4 and wherein R^3 and R^4 are hydrogen and n is 2.
 - 18. An integrated circuit comprising a silicon substrate, a diffusion barrier layer and a metal deposited on the diffusion barrier layer, wherein the diffusion barrier is covalently attached to the silicon substrate, and wherein the diffusion barrier is a self-assembled monolayer.
 - 19. The integrated circuit according to claim 18, wherein the self-assembled monolayer comprises subunits of the following structure:

$$\begin{cases} Q \\ O-Si-R^2 \end{cases}$$

- 4 wherein R² is an alkyl group, heteroalkyl group, aryl group or heteroaryl group:
- 1 20. The integrated circuit according to claim 19, wherein R² is an alkyl group of the following structure:

$$-(CH_2)_n R^5$$

- 4 wherein R³, R⁴ and R⁵ are independently selected from the group consisting of hydrogen,
- 5 alkyl groups, heteroalkyl groups, halo groups, NH₂, NHR⁶, NR⁶R⁷, OH, OR⁶, SH, SR⁶, CHO,
- 6 COOH and CN, and wherein R⁶ and R⁷ are alkyl groups, and wherein n is an integer ranging
- 7 from 1 to 5.

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- The integrated circuit according to claim 19, wherein R² is an alkyl 21.
- 2 group of the following structure:

$$-(CH_2)_n$$
 R^3
 R^4

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- wherein R³ and R⁴ are independently selected from the group consisting of hydrogen, alkyl 4
- groups, heteroalkyl groups, halo groups, NH₂, NHR⁶, NR⁶R⁷, OH, OR⁶, SH, SR⁶, CHO, 5
- COOH and CN, and wherein R⁶ and R⁷ are alkyl groups, and wherein n is an integer ranging 6
- from 1 to 5. 7
 - The integrated circuit according to claim 20, wherein R³, R⁴ and R⁵ are 22. hydrogen and n is 2.
 - The integrated circuit according to claim 21, wherein R² is an alkyl 23. group of the following structure:

$$-(CH_2)_n - R^3$$

and wherein R³ and R⁴ are hydrogen and n is 2.

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